

Dec. 26, 1944.

A. C. RUSSELL

2,366,056

CARBURETOR

Filed Jan. 31, 1941

3 Sheets-Sheet 1

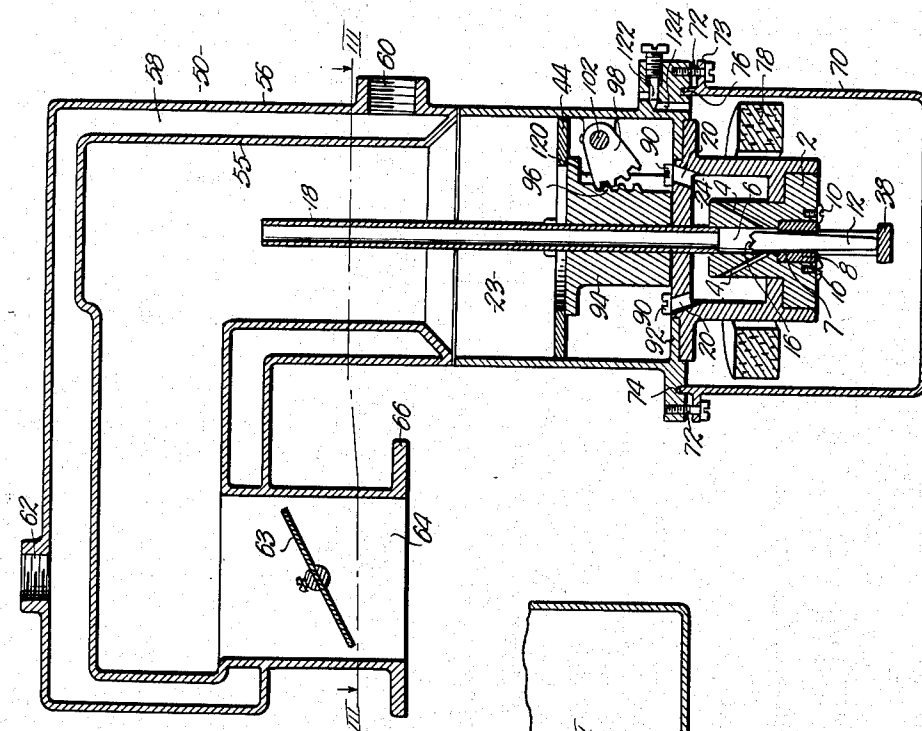


Fig. 1.

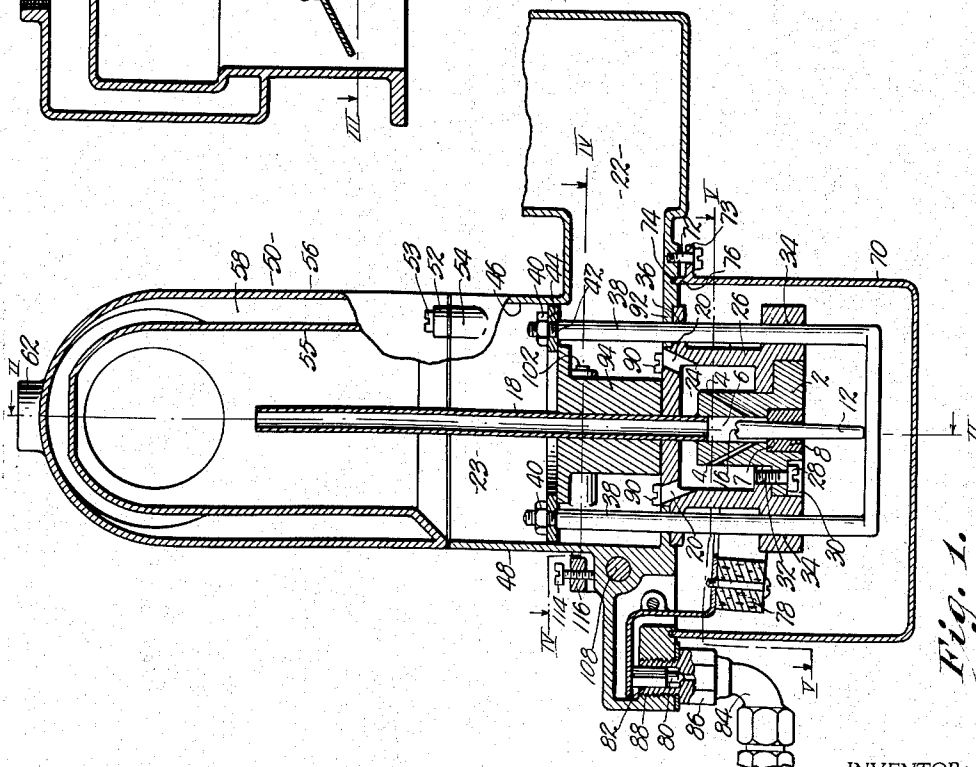


Fig. 2.

INVENTOR.
Andrew Craig Russell
BY *Paul H. Hovey*
ATTORNEY

Dec. 26, 1944.

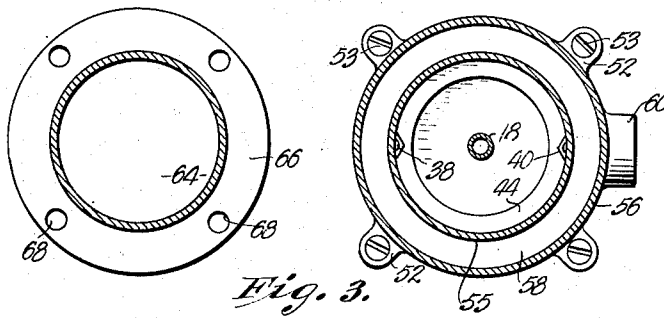
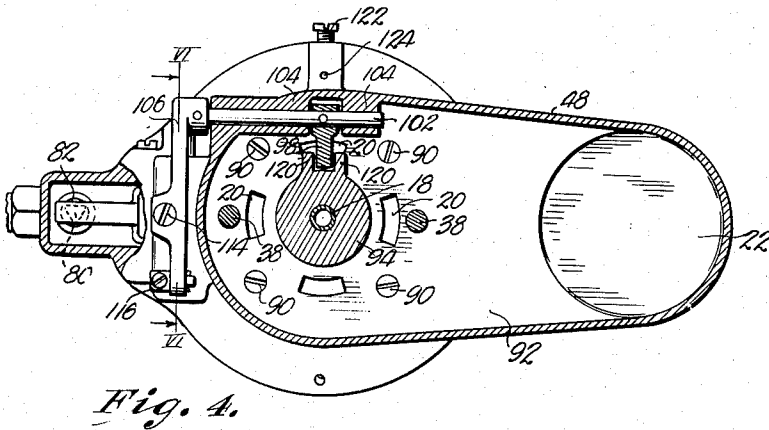
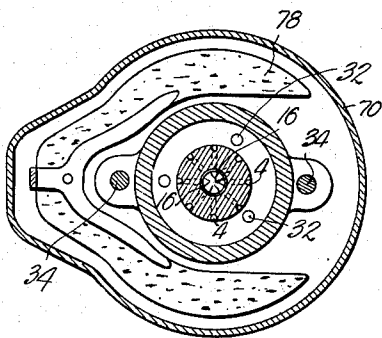
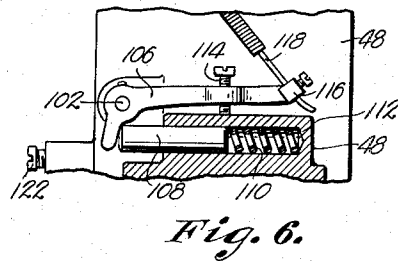
A. C. RUSSELL

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INVENTOR.
Andrew Craig Russell
BY *Paul Hovey*
ATTORNEY

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Fig. 7.

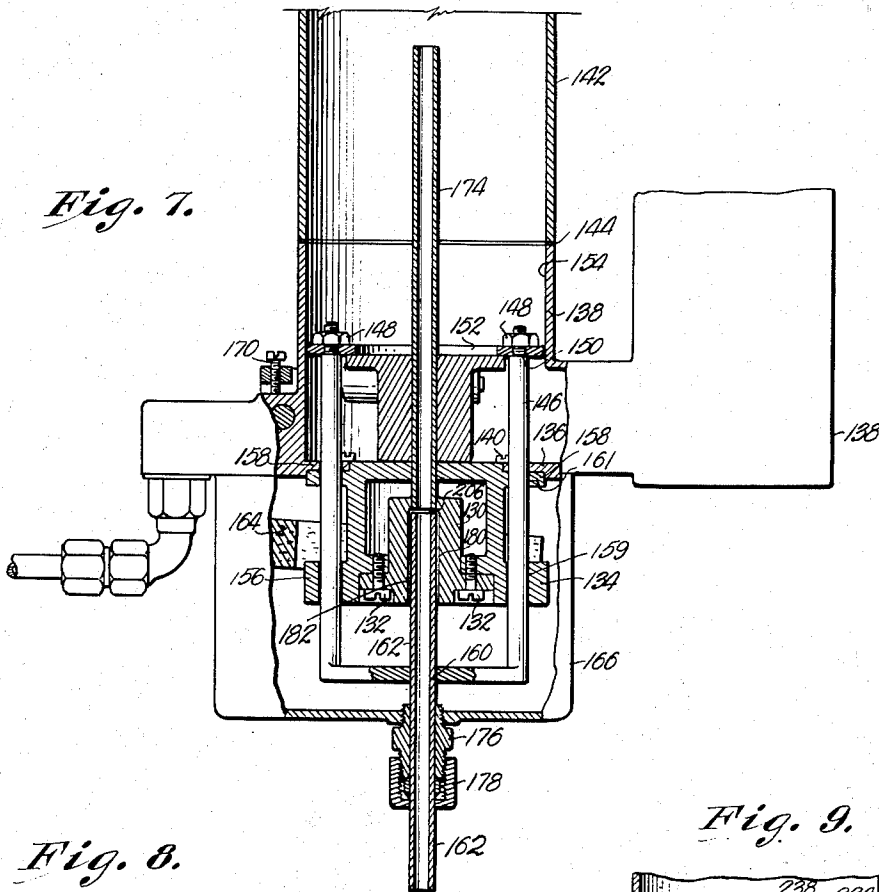


Fig. 8.

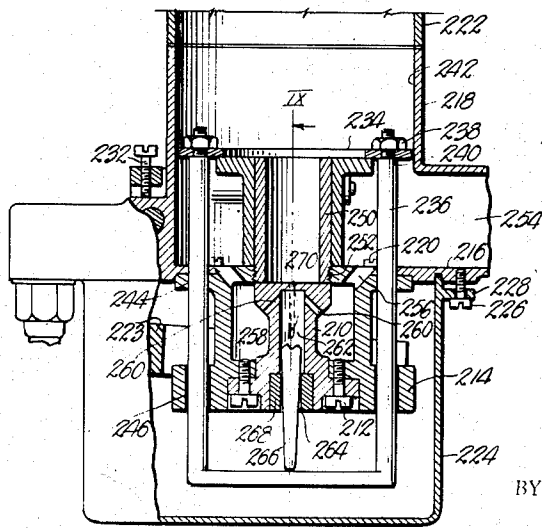
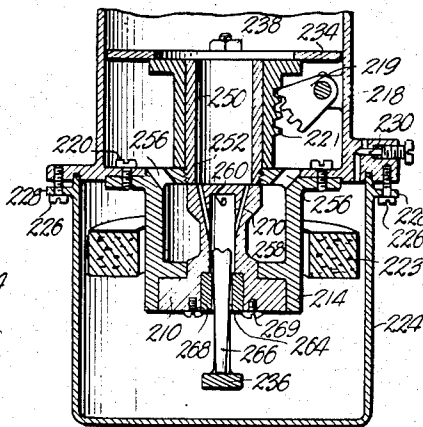


Fig. 9.



INVENTOR.
Andrew Craig Russell
BY *Carl Young*
ATTORNEY

UNITED STATES PATENT OFFICE

2,366,056

CARBURETOR

Andrew Craig Russell, Shawnee, Okla., assignor of
one-half to John Little Green, Shawnee,
Pottawatomie County, Okla.

Application January 31, 1941, Serial No. 376,788

10 Claims. (Cl. 261—50)

This invention relates to fluid mixing apparatus for internal combustion engines and has for its primary object the provision of unique, novel and efficient means for vaporizing liquid fuel prior to its introduction to the combustion chambers of such engines.

A further aim of this invention is to provide apparatus of the aforementioned character, wherein specially formed and arranged parts are combined to produce a new mode of mixing liquid fuel with air for internal combustion engines, which mode follows the broad concept of mixing air with the evolved vapors, droplets, etc., of the liquid fuel in a specially formed and disposed chamber.

A yet further object of this invention is the provision of apparatus for bringing together air and liquid fuel in a manner that requires only the commingling of fuel vapors and air after the latter has been introduced into the apparatus through paths of travel directed toward the surface of the fuel.

A still further object of this invention is the provision of apparatus of the aforementioned type wherein is included a hermetically sealed bowl for the fuel to be mixed with air and passages leading into said bowl which terminate above the level of the fuel therein, which passages have effective cross sectional areas substantially the same as the effective cross sectional areas of a conduit or the like arranged to carry from the bowl, combustible mixtures produced by the intermixing of said air with vapors, droplets, etc., from the fuel in the bowl.

Additional objects of the invention include the specific manner of forming the parts of the mixing apparatus, the relation between said parts that permits fuel to rise to the specially disposed mixing chamber, and the manner of introducing air through paths of travel always initially toward the surface of the liquid fuel.

In the drawings:

Fig. 1 is a vertical central sectional view through fuel mixing apparatus for internal combustion engines made in accordance with the present invention.

Fig. 2 is another vertical sectional view taken on line II—II of Fig. 1.

Fig. 3 is a transverse sectional view taken on line III—III of Fig. 2, looking in the direction of the arrows.

Fig. 4 is a fragmentary sectional view taken along line IV—IV of Fig. 1, and looking in the direction of the arrows.

Fig. 5 is a horizontal cross sectional view taken on line V—V of Fig. 1.

Fig. 6 is a fragmentary detailed sectional view taken on line VI—VI of Fig. 4.

Fig. 7 is a fragmentary vertical central sectional view through a fluid mixing apparatus made to embody a modified form of the present invention.

Fig. 8 is a fragmentary vertical sectional view through a fluid mixing apparatus illustrating a further modification of the present invention; and

Fig. 9 is a vertical sectional view taken on line IX—IX of Fig. 8.

In the form of the invention illustrated in Figs. 1 to 6 inclusive, nozzle member 2 is fitted with several, preferably four, air passages 4, arranged radially and directed downwardly so as to enter cylindrical mixing chamber 6 at a point above and near collar 8 which is held in place by bolts 10 shown in Fig. 2. The inner surface of collar 8 is cylindrical and somewhat smaller in cross sectional area than the inner surface of nozzle member 2 and forms an extension to chamber 6, as well as a valve seat 7 for valve 12.

Valve 12 is tapered inwardly toward its lower extremity and cooperates with chamber 6 and valve seat 7 to aid in metering the fluid passed through the apparatus. Valve 12 is of somewhat smaller cross sectional area at its large end than is chamber 6; and it is provided with notches 16 at its uppermost end that engages the lower end of conduit 18, which is inserted into nozzle member 6 at the upper end thereof, when the valve is raised to that position, thereby maintaining a passage from chamber 6 to conduit 18. Conduit 18 terminates in the path of travel of air passing through air outlet 23.

Channels 20 lead from air intake 22 into enclosure 24 formed by the exterior wall of nozzle member 2 and the interior wall of mounting 26. Nozzle member 2 is secured to mounting 26 by means of bolt 28 which is recessed in space 30 and secured to mounting 26 by means of threads 32.

The lower end of valve 12 rests on the horizontal part of U-shaped bracket 38 near its center, so as to permit raising and lowering of valve 12 by raising and lowering U-shaped bracket 38.

Mounting 26 is provided with holes 34 and with holes 36 to serve as bearings and guides for U-shaped bracket 38, that is affixed at its free ends by nuts 40 cooperating with shoulders 42 to an annular valve 44.

Annular valve 44 corresponds in outside diam-

eter to the shape and size of inner wall 46 of casing 48. Casing 48 is affixed to mixing conduit 50 by means of ears 52, bolts 53 and bosses 54.

Mixing conduit 50 is provided with an inner wall 55 and an outer wall 56 so as to form a chamber 58 between the two walls. This chamber is provided with an inlet connection 60 (shown in Fig. 2), and an outlet connection 62 so that exhaust gases or fluid from a cooling system may be caused to pass therethrough.

Fuel mixture passes from mixing conduit 50 through mouth 64 which is provided with flange 66 having holes 68 for attaching to intake manifold of the engine with which the apparatus is to be associated. Regulation of the flow of the mixture is obtained by means of butterfly valve 63 shown in Fig. 2.

Bowl 70 is attached by means of bolts 72 and ears 73 to the base of casing 48 which is provided with a recess 74 that extends around the lower side of the casing and is adapted to receive the edge 76 of the bowl so that an air tight connection may be made between the bowl and the casing. Bowl 70 hermetically seals the lower portion of the apparatus.

Within the bowl 70 is arranged a float 78 which controls a valve 80, the latter controlling the supply of fuel to bowl 70 through the opening 82. Opening 82 forms a part of the fuel line 84 which is secured to the casing 48 by means of nipple 86 and threads 88. Float 78 swings about its pivotal mounting as illustrated in Fig. 1. The level of liquid in bowl 70 cannot rise above the bottom of air passages 4 because valve 80 closes before such level is reached.

Mounting 26 is attached to casing 48 by means of bolts 90 which pass downwardly through the lower wall 92 of the casing.

Spool 94 is slidably mounted around conduit 18 so that it may be raised and lowered along the same by means of rack 96 formed along one side of spool 94 and gear 98 which is mounted so as to engage said rack, and thereby cause the spool to be raised and lowered when the gear is rotated. The under surface of spool 94 normally rests on the upper surface of lower wall 92.

In Fig. 4, gear 98 is fixed to shaft 102, journaled in bearings 104, and projects through casing 22 where it is secured to bell-crank lever 106. One arm of lever 106 is in contact with pin 108, yieldably held by spring 110 mounted in recess 112 formed in casing 48. The other arm of lever 106 is provided with an adjusting screw 114 and the free end of said other arm has a conventional locking mechanism 116 for holding choke cable 118. By operation of choke cable 118, spool 94 may be raised or lowered, thereby also raising or lowering U-shaped bracket 38, which in turn operates valve 12 to increase or decrease the flow of liquid fuel into the apparatus.

In normal operation when no choking is desired, the "pull" of the suction created by the motor will cause annular valve 44 to lift and air will be admitted to the area above spool 94 of casing 48 to be mixed with the fuel mixture leaving conduit 18. The amount of the "pull" exerted on annular valve 44, depends on the speed of the engine and therefore, the size of the opening between annular valve 44 and the top surface of spool 94 is increased or decreased according to the requirements of the engine at any given speed of operation. At the same time, U-shaped bracket 38 operates valve 12 so as to

provide a greater or lesser quantity of fuel, as may be required.

When it is desired to choke the engine or provide a richer mixture of fuel to air, operation of the choke cable 118 will cause the spool 94 to lift with the annular valve 44, thereby closing off the space which is normally between the two when the engine is operated. Only after spool 94 is lifted to the end of its upward path of travel, does absolutely true choking occur. Thus, the fuel mixture that reaches the engine will be the undiluted fuel mixture issuing from conduit 18.

Movement of the spool rotatably around conduit 18 in such manner as to disengage the gear and ratchet is prevented by projections 120.

Valve 122 (Fig. 2), may be adjusted to regulate the flow of air through passage 124 into bowl 70 to enable variation to a desired degree of the air admitted to said bowl.

During operation, the level of the fuel in the bowl 70 is kept at a point just below the lower ends of the downwardly projecting air passages 4. The path of the air is initially down as it passes through nozzle member 2. The air on leaving passages 4 comes in contact with the surface of the fuel that flows into the opening between the valve 12 and the sides of the nozzle member 2, which is great enough to allow the formation of a definite fuel surface. The air then passes upwardly into conduit 18. As the air comes in contact with the liquid fuel it has a tendency to force the same downwardly. As it passes across the liquid fuel it carries off a part thereof in the form of vapor and droplets and in that way the air becomes saturated with fuel. The saturated air then rises through chamber 6 and into conduit 18 which is substantially the same in effective cross sectional area as the sum of the effective cross sectional areas of all the air passages 4.

Upon leaving conduit 18 this saturated air is mixed with the air drawn through outlet 23 from the port formed between annular valve 44 and the top surface of spool 94 when said ring is in an operative position.

Another modification of the invention is shown in Fig. 7, wherein the numeral 130 designates a nozzle member secured by means of bolts 132 to mounting 134. Mounting 134 is in turn secured to lower wall 136 of casing 138 by means of bolts 140. Mixing conduit 142 is shown as terminating at a point a short distance above its connection 144 with casing 138, but said mixing conduit may be of the same design as the mixing conduit shown in Fig. 2.

U-shaped bracket 146 is secured by means of nuts 148 and shoulders 150 to annular valve 152, whose outer circumference corresponds in size and shape to the inner wall 154 of casing 138. Valve 152 is slidable along the inner wall 154 and is positioned in a horizontal plane as it slides by means of the U-shaped bracket 146, journaled in bearings 156 and 158. The lower portion of said U-shaped bracket is provided with an opening 160 enabling said bracket to be fitted slidably around air tube 162. Holes 159 and 161 form bearings for said bracket.

Float 164 is shown, but the float mechanism is omitted from Fig. 7 as it is the same as said mechanism in Fig. 1.

Bowl 166 seals off all the apparatus below casing 138 and excludes all air therefrom except that which is allowed to enter through a valve not shown in Fig. 7, but similar to valve

122, the character of which is as shown in Fig. 2 and previously described.

Choke adjusting screw 170 is the same as is shown at 114 in Fig. 6. The rest of the associated choke parts, not shown in Fig. 7, are the same as those shown in Fig. 6. They contrive to raise spool 172, slidably mounted around conduit 174. This action closes off the air passage between valve 152 and spool 172, thereby insuring that the fuel mixture reaching the engine will be comparatively less dilute if desired.

Air tube 160 is adjustably held by fitting 176 provided with tightening means 178, whereby longitudinal adjustment of air tube 180 may be made.

Air tube 160 projects into opening 180 formed in nozzle member 130, said opening 180 being slightly larger in diameter than air tube 160, whereby liquid fuel may be drawn into the space 182 between air tube 160 and the sides of the nozzle member adjacent thereto by the action of the passage of air through the apparatus.

Air tube 160 is in longitudinal alignment with and positioned slightly below the lower end of conduit 174 to form a small chamber 206 between the ends of tube 160, and the conduit 174. Conduit 174 fits tightly into an opening at the upper end of nozzle member 130. Passage of air through the apparatus results in the mixing of a small amount of the fuel in the form of vapor with the air.

Making the various adjustments as described permit the operator to obtain the desired fuel mixture.

A third modification of the invention is shown in Figs. 8 and 9, wherein the numeral 210 designates a nozzle member secured by means of bolts 212 to mounting 214 secured to lower wall 216 of casing 218 by means of bolts 220. Casing 218 is attached to mixing conduit 222 of which only a broken section is shown but same being like that of vent 30 of Fig. 1.

A float mechanism 223 like that shown in Fig. 1 is used to determine the level of the fuel in bowl 224. Bowl 224 is affixed to casing 218 by means of bolts 226 and ears 228. It effectively seals off the lower part of the apparatus from the surrounding atmosphere. Valve 230, like that previously described, is used to admit the desired amount of air to the interior of bowl 224.

Adjusting screw 232 forms a part of the choke mechanism shown in detail in Fig. 6.

Annular valve 234 is affixed to U-shaped bracket 236 by means of bolts 238 and shoulders 240. The outer circumference of the annular valve is complementary to the shape and size of the interior wall 242 of casing 218. This valve 234 is positioned laterally by means of the U-shaped bracket 236 journaled in holes 244 and 246 for vertical sliding movement when air pressure exerted on the under side of ring 234 causes the same to travel upwardly.

When the engine is at rest, valve 234 is positioned on the upper surface of spool 218 slidably mounted around hollow cylinder 250, secured by means of threads 252 to the lower wall 216 of the casing 218.

Mechanism for moving the spool vertically, to close off the opening between valve 234 and the upper surface of spool 248, when the engine is operating, in order to choke the engine, is shown in Figs. 2 and 4 and is the same as that employed in this modification. Gear 219 and rack 221 are shown in Fig. 9.

Air from the intake opening 254 of casing 218

is admitted through channels 256 to enclosure 258 formed between the inner walls of the mounting 214 and the outer walls of nozzle member 210. Air is then drawn from enclosure 258 upwards through air passages 260 into chamber 262. This air is then deflected downwardly until it comes in contact with the fuel which is drawn into the opening 264 between valve 266 and cylindrical collar 268, somewhat smaller in diameter than chamber 262 and the upper part of valve 266 to form a valve seat 268 for said valve. Said collar 268 is retained by bolts 269.

After the air has absorbed a quantity of fuel, it reverses its direction and passes upwardly and outwardly, through conduits 270 that have the approximate effective total cross sectional area as air passages 260. This vapor mixture is then carried on up through hollow cylinder 250 from where it passes into the upper part of casing 218, to then be passed to vent 222. Additional air is mixed with the vapor mixture as it passes through these portions (218 and 222) of the apparatus in the same manner as has hereinbefore been described.

When the engine is operating normally, the valve 266 is positioned by the action of ring 234 and U-shaped bracket 236 in a manner as previously described with respect to Figs. 1 and 2. Valve 266 is fitted with notches 272 in its upper end to preserve an air passage when the valve is at the end of its path of travel upwardly.

It will be obvious to one skilled in the art the manner in which this apparatus accomplishes the end contemplated by this invention when the various forms of apparatus, illustrated and described, are understood, and since apparatus having physical characteristics different from those shown may be made to embody the invention, it is desired to be limited only by the spirit of the invention and scope of the appended claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In apparatus of the character described, a hollow casing provided with an air intake, an air outlet and a bowl for the fuel to be mixed with air; a member in the bowl having a mixing chamber therein and at least one passage for directing air into the mixing chamber and thence downwardly against the surface of the fuel therein, said passage terminating above the level of the fuel in said bowl; and a conduit in communication with the mixing chamber disposed to introduce fuel mixture from the latter to air passing from the casing through the said outlet.

2. In apparatus of the character described, a hollow casing provided with an air intake, an air outlet and a bowl for the fuel to be mixed with air; a member in the bowl having a mixing chamber therein, and at least one passage for directing air into the mixing chamber and thence downwardly against the surface of the fuel therein, said passage terminating above the level of the fuel in said bowl; and a conduit in communication with the mixing chamber disposed to introduce fuel mixture from the latter to air passing from the casing through the said outlet, the effective cross sectional area of the passage being substantially the same as the effective cross sectional area of the conduit.

3. In apparatus of the character described, a hollow casing provided with an air intake, an air outlet and a bowl for the fuel to be mixed with air; a member in the bowl having a mixing

chamber therein, and at least one passage for directing air into the mixing chamber and thence downwardly against the surface of the fuel therein, said passage terminating above the level of the fuel in said bowl; a conduit in communication with the mixing chamber disposed to introduce fuel mixture from the latter to air passing from the casing through the said outlet; and means for altering the size of said mixing chamber.

4. In apparatus of the character described, a hollow casing provided with an air intake, an air outlet and a bowl for the fuel to be mixed with air; a member in the bowl having a mixing chamber therein, and at least one passage for directing air into the mixing chamber and thence downwardly against the surface of the fuel therein, said passage terminating above the level of the fuel in said bowl; a conduit in communication with the mixing chamber disposed to introduce fuel mixture from the latter to air passing from the casing through the said outlet; and means for altering the size of said mixing chamber, the effective cross sectional area of the passage being substantially the same as the effective cross sectional area of the conduit.

5. In apparatus of the character described, a hollow casing provided with an air intake, an air outlet and a bowl for the fuel to be mixed with air; a member in the bowl having a mixing chamber therein, and at least one passage for directing air into the mixing chamber and thence downwardly against the surface of the fuel therein, said passage terminating above the level of the fuel in said bowl; and a conduit in communication with the mixing chamber disposed to introduce fuel mixture from the latter to air passing from the casing through the said outlet, said bowl being hermetically sealed and provided with means for admitting a predetermined amount of air thereto from the atmosphere.

6. In apparatus of the character described, a hollow casing provided with an air intake, an air outlet and a bowl for the fuel to be mixed with air; a member in the bowl having a mixing chamber therein, and at least one passage for directing air into the mixing chamber, said passage terminating above the level of the fuel in said bowl; a conduit in communication with the mixing chamber disposed to introduce fuel mixture from the latter to air passing from the casing through the said outlet; and a structure adjacent to the mixing chamber for conveying fuel toward the latter from the bowl in a direction opposite to the initial direction of flow of air into the mixing chamber from said passage.

7. In apparatus of the character described, a hollow casing provided with an air intake, an air outlet and a bowl for the fuel to be mixed with air; a member in the bowl having a mixing chamber therein in communication with the bowl and a plurality of passages in communication with the mixing chamber extending downwardly from the air intake toward the fuel level in said bowl and terminating above said level; a conduit in communication with the mixing chamber and extending to a point in the

air stream passing through the said outlet port; and means for altering the size of said mixing chamber as the volume of air drawn through the air outlet is varied, said passages being arranged to direct air moving therethrough toward a point within the mixing chamber on the extended longitudinal axis of said conduit.

8. In apparatus of the character described, a hollow casing provided with an air intake, an air outlet and a bowl for the fuel to be mixed with air; a member in the bowl having a mixing chamber therein in communication with the bowl and a plurality of passages in communication with the mixing chamber extending downwardly from the air intake toward the fuel level in said bowl and terminating above said level; a conduit in communication with the mixing chamber and extending to a point in the air stream passing through the said outlet port; and means for altering the size of said mixing chamber as the volume of air drawn through the air outlet is varied, said passages being arranged to direct air moving therethrough toward a point within the mixing chamber on the extended longitudinal axis of said conduit, said conduit being comparatively long and on the axis of the air stream wherein the end thereof is disposed.

9. In apparatus of the character described, a hollow casing provided with an air intake, an air outlet and a bowl for the fuel to be mixed with air; a member in the bowl having a mixing chamber therein in communication with the bowl and a plurality of passages in communication with the mixing chamber extending downwardly from the air intake toward the fuel level in said bowl and terminating above said level; a conduit in communication with the mixing chamber and extending to a point in the air stream passing through the said outlet port; and a valve extending into the mixing chamber to form a narrow space therearound between the outer face thereof and the inner face of the member in the chamber, said passages being in direct communication with said narrow space.

10. In apparatus of the character described, a hollow casing provided with an air intake, an air outlet and a bowl for the fuel to be mixed with air; a member in the bowl having a mixing chamber therein in communication with the bowl and a plurality of passages in communication with the mixing chamber extending downwardly from the air intake toward the fuel level in said bowl and terminating above said level; a conduit in communication with the mixing chamber and extending to a point in the air stream passing through the said outlet port; and a valve extending into the mixing chamber to form a narrow space therearound between the outer face thereof and the inner face of the member in the chamber, said passages being in direct communication with said narrow space, said valve being movable into and from the mixing chamber to alter the size of the said narrow space.

ANDREW CRAIG RUSSELL.